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Because of small class enrollment, limited class offerings, and differences in ability range, a programmed algebra course was introduced to eliminate some disadvantages of a small school mathematics program. Credit was given to students completing 36 of the 73 chapters in Science Research Associates (SRA) Modern Mathematics, Course I. Post-test scores indicated a gain ratio of .63 compared to pre-test scores. Criticism of the programmed course included the difficulty of chapter tests and the use of multiple choice questions. A statement of problems and objectives and a sample progress report to parents conclude the document. (JH)

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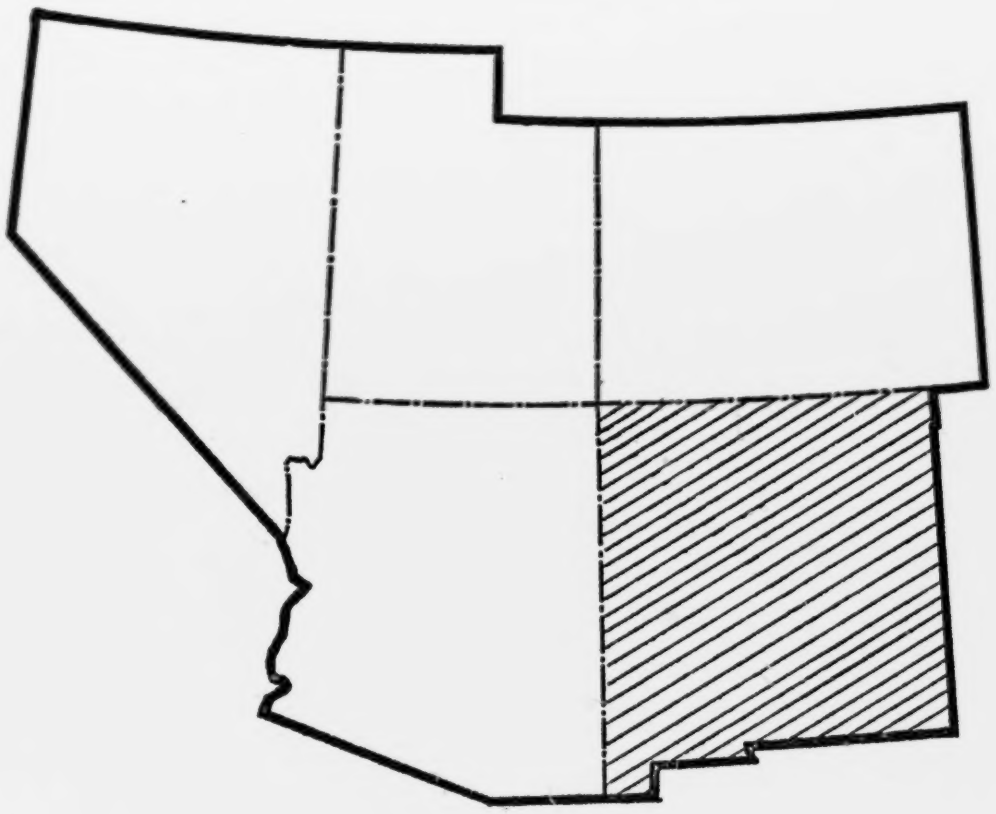
# NEW MEXICO

# Western States Small Schools Project

## PROGRAMMED MATHEMATICS

### Dora High School



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NOVEMBER 1965

# Foreword

The purpose of this publication is to assist administrators and teachers contemplating the use of programmed mathematics in their schools. We hope to assist by reporting the classroom experience of Mr. J. D. Green, high school mathematics teacher in the Dora Public Schools, Dora, New Mexico, with programmed mathematics.

This study was conducted under the auspices of the New Mexico Western States Small Schools Project, a project directed by the New Mexico State Department of Education and financed by the Ford Foundation.

The consultant for this study was Miss Lura Bennett, Specialist in Mathematics, New Mexico State Department of Education, who worked consistently with the teacher and students.

The evaluation of the teaching effectiveness of the programmed course was done by Dr. Henry C. Ellis, Associate Professor of Psychology, The University of New Mexico, Albuquerque.

DAN D. CHAVEZ
*Project Director*

# Problems and Objectives

## PROBLEMS

*General*:

The small size of the Dora Municipal School severely restricts the mathematics curricula

*Specific*:

1. Difficult scheduling and limited course offerings
2. Small class enrollments of 1 to 3 students
3. A high percent of graduates attend college (approximately 70%)
4. Providing for individual instruction
5. Differences in ability range make instruction difficult

## OBJECTIVES

*General*:

To eliminate some of the disadvantages of a small school mathematics program.

*Specific*:

1. To give each student some measure of success in mathematics
   a. By permitting him to progress at his own rate
   b. By providing individualized instruction
2. To provide more advanced courses for the college capable
   a. In multiple class situations if necessary
   b. By making it possible for the better student to take courses not usually offered
3. To introduce sound modern mathematics
4. To present mathematics content in a form such that students attending school shall not be penalized by the absence of the significant number of students who participate in away-from-school activities throughout the year

# Programmed Mathematics: Organization and Administration

This section is separated into subsections regarding the programmed course used, organization and administration, grading and reporting to parents, comments on program instruction, comments on the programmed course used, and observations.

*Programmed Course Used*

The programmed course used was *Modern Mathematics, Course I*, published by Science Research Associates, Incorporated. It is a programmed course in updated Algebra, covering the introductory elements of traditional first year Algebra. The programmed course consists of 73 chapters; these are included in ten books.

*Organization and Administration*

This year 18 freshmen and one junior, who was repeating Algebra I, were enrolled in Algebra I. Any student wishing to take Algebra I was permitted to enroll.

The class met five periods a week; each period was 55 minutes in length.

The use of the programmed material was introduced to the students by using transparencies of the first chapters on the overhead projector.

The typical class period consisted of giving chapter tests to students finishing a chapter, grading and discussing the results of chapter tests and/or giving individual instruction. However, due to the rapid progress of the class, it was necessary to obtain the services of a student aide to grade and record the chapter tests and thus permit the teacher to work with the individual students. This student aide was available from September to December.

Soon after mid-term when all but 2 or 3 students were studying equations, we had eight lecture periods over a period of three weeks. These lecture periods were devoted to the review and the applications of certain principles used in solving equations.

At the end of the year three lecture periods were used to give a quick review of the material covered in the first 36 chapters in preparation for the final tests.

*Grading and Reporting to Parents*

The grades were based on (1) the average of tests passed, (2) the number of tests passed, and (3) the total number of tests taken. The student was required to to pass the test on each chapter. If the student did not pass the chapter test, he was expected to do the chapter over and take another (and usually different) test over the same chapter. The student could take the chapter test three times. If he did not pass the chapter test on the third try, he proceeded to the next chapter anyway. Due to the difficulty of the chapter tests furnished by the publisher, the lowest passing grade was set at 60 rather than the 70 required in the conventional class at Dora.

The grades were reported to parents at the end of each nine weeeks grading period on the regular report card. At the end of the third nine weeks, a form letter was sent to the parent indicating (a) the chapter on which the fastest and slowest student were working, (b) the chapter their child was working, and (c) the number of chapters their child had worked each of the three grading periods. See Appendix A.

*Credit*

One credit was granted to those students completing 36 or more chapters. These students, unlike last year's students, will not be permitted to continue work this coming school term (1965-66) for extra credit. The two students who did not complete 36 chapters in the program this year will be given a grade of "Incomplete." However, the two students will be permitted to complete the additional chapters in order to receive a credit in Algebra I.

*Last Year's Class*

Last year (1963-64) 18 freshman, 1 sophomore, and 1 senior were enrolled in Algebra I. At the end of the year, 14 students remained in the class. Of these, 10 covered enough material to receive one credit in Algebra I; six of these students were advised to finish the work remaining in the programmed course this school year; all of these students had completed the entire program—73 chapters—by the end of the third nine weeks period. They received additional credit under the heading of "Elective Mathematics."

The four students not covering enough material were given a mark of "Incomplete" with the understanding that they could cover enough material this year (1964-65) to receive one credit in Algebra I. Three of the four completed the re-

quired portion of the program by the end of the tenth week and received a credit in Algebra I. The other student withdrew from the course.

The above students did their work in a study hall supervised by the teacher. They were given a short review at the beginning of the school year by means of a series of lectures. After this, they started to work on the program where they had left off the previous year.

*Comments on Programmed Instruction*

The outstanding quality of programmed instruction is that it permits each student to work to the best of his ability without the penalty of failure. A less gifted student may put in a great deal more time and, perhaps, more effort to learn the same material than a better student; but he can do it with a programmed textbook.

This type of teaching teaches the student self-reliance. If he does not get busy and do the work, then it remains undone.

When a student does need assistance, the teaecher is concerned with *his* problem and he can get the type of explanation he needs. In other words, I think there is rapport in this type of teaching that does not exist in a conventional classroom.

In order to make the most effective use of programmed instruction, the teacher needs the assistance of an aide in the classroom who will administer tests and grade tests. Thus, the teacher is then free to discuss the test with the student. Failure to immediately grade a chapter test and then discuss the test with the student results in the student wasting time and causing a disturbance.

*Comments on the Program*

The program is excellent. However, this text does not teach the pupil to do the necessary work. Example: The student does simpler equations mentally and does not acquire the techniques required to solve the more complicated equations.

The chapter tests often require the student to do work that has not been covered in the chapter. Also, the multiple choice type question as used in the chapter tests make it easier to cheat on a test; a question requiring the student to show his work is preferable.

# Evaluation of Teaching Effectiveness of Modern Mathematics, Course I

a. *School*: Dora

b. *Teacher*: J. D. Green

c. *Program*: *SRA Modern Mathematics, Course I*

d. *Sample*: N = 14

e. *Summary Table of Results*:

| | *Pre-Test* | *Post-Test*[1] | *Gain* |
|---|---|---|---|
| Mean | 23.56 | 71.36 | 48.40* |
| S. D. | 13.09 | 18.86 | |

*t = 8.13, df - 13, p < .01

f. *Gain Ratio*: .63

g. *Summary and Conclusions*:

Students showed a significant amount of learning as a result of using *SRA Modern Mathematics*. The average gain was 48 points which was significant beyond the .01 level of confidence. Students learned 63% of what they could have possibly learned, as assessed by the gain ratio. Some evidence for increase in variability was noted on the post-test.

[1] Post-test scores were *adjusted* so as to take into account the fact that all students did not finish the program.

# Appendix A. Progress Report to Parents

Dear Mr. and Mrs. .....:

As you probably know, your child is enrolled in an Algebra I course and is using an experimental textbook which permits the students to work as rapidly as they can.

We thought you might like to know that:

| The fastest student is on Chapter | The slowest student is on Chapter | Your child is on Chapter |
|---|---|---|
| 59 | 24 | 30 |

The chart below indicates the number of Chapters which.....completed each nine weeks.

| First Nine Weeks | Second Nine Weeks | Third Nine Weeks |
|---|---|---|
| | | |

We would appreciate any comments or suggestions from you.

Yours sincerely

J. D. GREEN, *Mathematics Teacher*

GUY LUSCOMBE, *Principal*